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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/788,105	02/16/2001	Jay E. Uglow	LAM1P106D	2844

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EXAMINER

PHAM, THANHHA S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 07/11/2003

14

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/788,105

Applicant(s)

UGLOW ET AL.

Examiner

Thanhha Pham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-24 and 26-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-24 and 26-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 11.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

This Office Action responses to Applicant's Amendment in Paper No. 13 dated 4/23/03.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

1. Claim 41 is rejected under 35 U.S.C. 102(e) as being anticipated by Parikh [US 6,225,207].

Parikh, fig 3E and col 1-19, discloses a claimed multi-layer dielectric disposed over a substrate for use in dual-damascene applications comprising:

a barrier layer (312) disposed over the substrate (310);

an inorganic dielectric layer of a fluorine doped oxide (314, F-SiO₂, col 8 lines 66-67 and col 9 lines 1-2) disposed over the barrier layer, the inorganic dielectric layer having a first thickness; and

a low dielectric constant layer of a carbon doped oxide (316, divinyl siloxane benzocyclobutane, col 9 lines 3-20) disposed directly over the inorganic dielectric layer (314), the low dielectric constant layer having a second thickness;

wherein a via path (340) is configured to be defined in an entire portion of the first thickness of the inorganic dielectric layer and in at least a portion of the second thickness of the low dielectric constant layer.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Parikh [US 6,225,207] in view of Yu et al [US 6,187,663].

Parikh, fig 3E and col 1-19, discloses a multi-layer dielectric layer over a substrate for use in dual-damascene applications comprising:

a barrier layer (312) disposed over the substrate (310);
an inorganic dielectric layer (314, PECVD-SiO₂ or F-SiO₂, col 8 lines 66-67 and col 9 lines 1-2) disposed over the barrier layer; and
a low dielectric constant layer (316, col 9 lines 3-20) disposed directly over the inorganic dielectric layer (314);
wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

Parikh et al is silent about the inorganic dielectric layer of PECVD-SiO₂ or F-SiO₂ having a dielectric constant of about 4. However, the claimed range of dielectric constant of about 4 is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. The claim is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA 1980) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Moreover, Yu et al (fig 6, col 3 lines 35-39) teaches the inorganic dielectric layer (4) of fluorine doped silicon dioxide (FSG) having the dielectric constant of about 4 (3.5-3.7). Therefore, it would have been obvious for those skilled in the art to use the inorganic dielectric layer having the dielectric constant of about 4 as being claimed, per taught by Yu et al, to define the via in the dual damascene application of Parikh. Selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

2. Claims 21-23 are rejected under 35 U.S.C. 103(a) as being being unpatentable over Wang et al [US 6,255,735] in view of Yu et al [US 6,187,663].

Wang et al, fig 9 and cols 1-8, discloses the claimed multi-layer dielectric layer/structure over a substrate for dual damascene applications comprising:

- a barrier layer (12, silicon nitride, col 5 lines 28-31) disposed over the substrate (10);

- an inorganic dielectric layer of a fluorine doped oxide (14, SiOF, col 5 lines 40-41) disposed over the barrier layer; and

- a low dielectric constant layer (18, col 5 lines 51-67 and col 6 lines 1-11) disposed directly over the inorganic dielectric layer (14);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

Wang et al is silent about the inorganic dielectric layer of fluorine doped oxide SiOF having a dielectric constant of about 4. However, the claimed range of dielectric constant of about 4 is considered to involve routine optimize routine optimization while has been held to be within the level of ordinary skill in the art. The claim is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA 1980) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Moreover, Yu et al (fig 6, col 3 lines 35-39) teaches the inorganic dielectric layer (4) of fluorine doped silicon dioxide (FSG) having the dielectric constant of about 4 (3.5-3.7). Therefore, it would have been obvious for those skilled in the art to use the inorganic dielectric of fluorine doped oxide having the dielectric constant of about 4 as being claimed, per taught by Yu et al, to define the via in the dual damascene application of Wang et al. Selection of a known material based on its suitability for its

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intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

3. Claims 24 and 26-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al [US 6,255,735] in view of Yu et al [US 6,187,663] as applied to claim 23 above, and further in view of Usami [US 6,077,574].

➤ With respect to claim 24, Wang et al in view of Yu et al substantially discloses the claimed multi-layer dielectric layer over a substrate for use in dual-damascene application except teaching the low dielectric constant layer being of a carbon doped oxide.

However, Usami teaches using the carbon-doped oxide layer would provide a better low constant dielectric layer with good resistance to moisture and heat.

Therefore, it would have been obvious for those skilled in the art to modify the multi-layer dielectric layer of Wang et al by using the low constant dielectric layer of carbon doped oxide, as taught by Usami, to form the multi-layer dielectric layer with a good characteristics of low RC, good resistance to moisture and resistance to heat.

➤ With respect to claim 26, Wang et al (col 5 lines 51-67) discloses the inorganic dielectric layer (14) has different material properties than the low dielectric constant layer (18).

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➤ With respect to claim 27-30, the claimed ranged thickness of the inorganic dielectric layer and the low dielectric layer are considered to involve routine experimentation while has been held to be within the level of ordinary skill in the art. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA 1980) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

4. Claims 31-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith [US 6,277,733] in view of Usami [US 6,077,574].

➤ With respect to claims 31 and 36, Smith, fig 2c and col 1-5, discloses the claimed multi-layer dielectric structure for dual damascene applications comprising:

a barrier layer (422, col 3 lines 26-27) disposed over the substrate (402) and a base dielectric (416);

an inorganic dielectric layer of un-doped TEOS oxide or fluorine-doped oxide (424, col 3 lines 25-27) disposed over the barrier layer;

a low dielectric constant layer (430, col 3 lines 56-62) disposed directly over the inorganic dielectric layer (424);

wherein the low dielectric constant layer is configured to receive metallization line trenches and the inorganic dielectric layer is configured to receive vias during a dual damascene process.

Smith does not expressly teach using the low dielectric constant layer of carbon doped oxide.

However, Usami teaches using the carbon-doped oxide layer would provide a better low constant dielectric layer with a good resistance to moisture and heat.

Therefore, it would have been obvious for those skilled in the art to modify the multi-layer dielectric structure of Smith by using the low constant dielectric layer of carbon doped oxide, as taught by Usami, to provide a better multi-layered dielectric structure in dual damascene application for making a better device with low RC and good resistance to moisture & heat .

➤ With respect to claims 32-35, and 37-40, the claimed ranged thickness of the inorganic dielectric layer and the low dielectric layer are considered to involve routine experimentation while has been held to be within the level of ordinary skill in the art. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is

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different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA 1998) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Response to Arguments

5. Applicant's arguments filed 4/23/03 to claims 31-40 have been fully considered but they are not persuasive.

Regard to Applicant's argument on pages 15-16 about rejection of unpatentable over Smith in view of Usami, Applicant argues "Smith fails to teach a low dielectric constant layer disposed directly over an inorganic dielectric layer". The argument is not persuasive because Smith does teach the low dielectric constant layer (430, fig 2c) disposed directly over the inorganic dielectric layer (424, un-doped TEOS or FSG). Although some portion of the low dielectric constant (430) is formed over the hard mask (426), the low dielectric constant (430) is still disposed directly over the inorganic dielectric layer (424, un-doped TEOS or FSG). Applicant is respectfully reminded that "directly over" does not mean "directly contact on" since term "directly contact on" is used to describe a layer being directly contact on another layer wherein no other layer being there between. Moreover, Applicant's attention is respectfully direct to fig 2c of Smith reference, the low dielectric constant layer (430, fig 2c) is disposed directly over the inorganic dielectric layer (424, un-doped TEOS or FSG) wherein a portion of the low

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dielectric constant layer (403) is directly contact on the inorganic dielectric layer (424, un-doped TEOS or FSG).

Based on what being discussed above, claims 31-40 stand rejected over Smith in view of Usami because Smith in view of Usami discloses the low dielectric constant of the carbon doped oxide is disposed directly over the inorganic dielectric layer (see rejection above).

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-

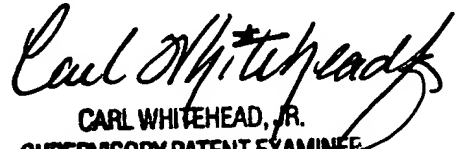
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6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
July 3, 2003


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800